DUSEL Beam Facility Civil Coordination Meetings / Design Efforts

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Weekly Civil Coordination Meetings Beginning Jan. '09

GOALS:

- Establish preferred facility layout on FNAL site
  - Evaluation of facility construction options, including impact on siting and cost
    - An example here is for the target hall: whether to mine in structural rock (as per NuMI), or a deep "cut and cover" facility.
    - Mining appears to be the clearly favored approach
  - Include technical requirements inputs and assess impacts for facility construction
    - P. Lucas presentation for primary beam layout
- Obtain first level understanding of facility construction costs and duration
- Conceptual Design Report Document

Some DUSEL Beam Facility Constraints – Compared to NuMI

- Large horizontal bend required to aim primary beam toward DUSEL
- Greater target hall width and height, combined with need for added rock cover, give significantly lower beam elevation at target
- Steeper neutrino beam angle, balanced somewhat by shorter decay region
- Significant increase in decay tunnel diameter, due to increased decay pipe radius and added surrounding shield
- Impact of deep facility construction. MUCH closer to FNAL neighbors. (Must mitigate noise and vibration effects)

Facility Layout Plan View

Some Inputs for DUSEL Beam Target Hall Design

Excerpts from note by J. Hylen (with input from K Anderson, P. Hurh, C. Laughton)

- **Some initial thoughts on layout of a target hall for the proposed FNAL-to-DUSEL neutrino beam-line.** We start with the NuMI target hall, and see what modifications would make sense for DUSEL.

- **1) Shielding.** Due to an order of magnitude more beam power for DUSEL, assume an **extra 3 ft. of concrete shielding above, below, beam-left, beam-right, and upstream of the target pile.**
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- **2) NuMI target pile length** was designed to accommodate focusing of high energy neutrinos by having the second horn moved far down-stream. **For DUSEL, only the low energy neutrinos are desired, and the layout can be shortened** . 75 ft of the distance between the end of the second horn can be eliminated. (Note space for shielding stacking and work-cell must be addressed differently)
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- **3) The DUSEL beam-line is almost twice as steep.** If one maintained the NuMI target hall length, this would lead to a very awkward (very tall) space at the down-stream end of the target hall. **Since the focusing length can be shorter, it makes more sense to shorten the target hall, and make it wider to gain back the space for shielding storage, work-cell, etc.** The current target hall is 27 ft wide. Input from our tunneling expert is that **a width of 60 ft** is a reasonable limit from tunnel construction -- this would give us a similar area for shielding storage, work-cell, etc to what we have now. **Note the amount of rock above the target hall ceiling needs to be increased from the NuMI case if the target pile is wider; initial guidance is that a 60 ft span will require 60 ft of good rock above it.**
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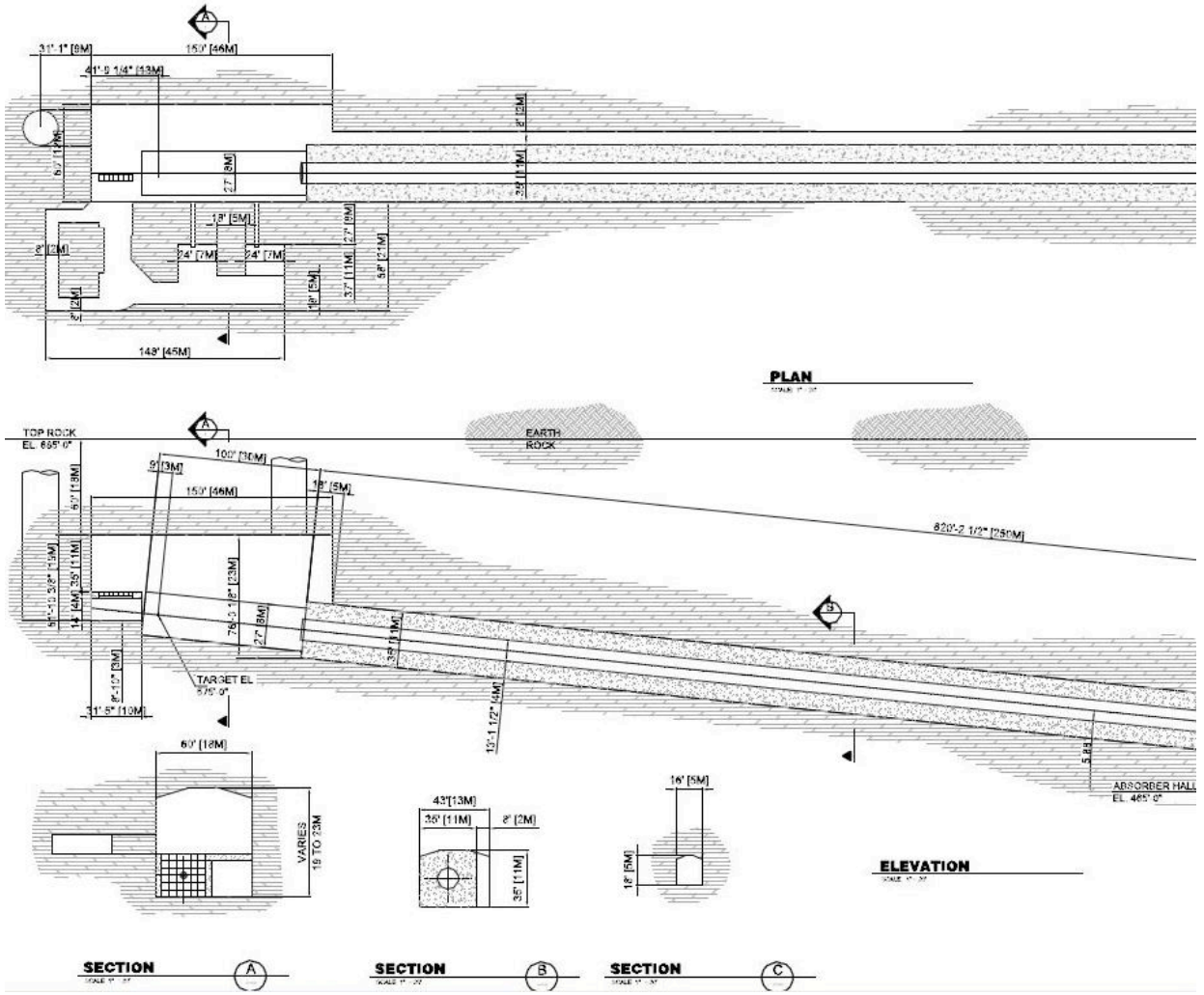
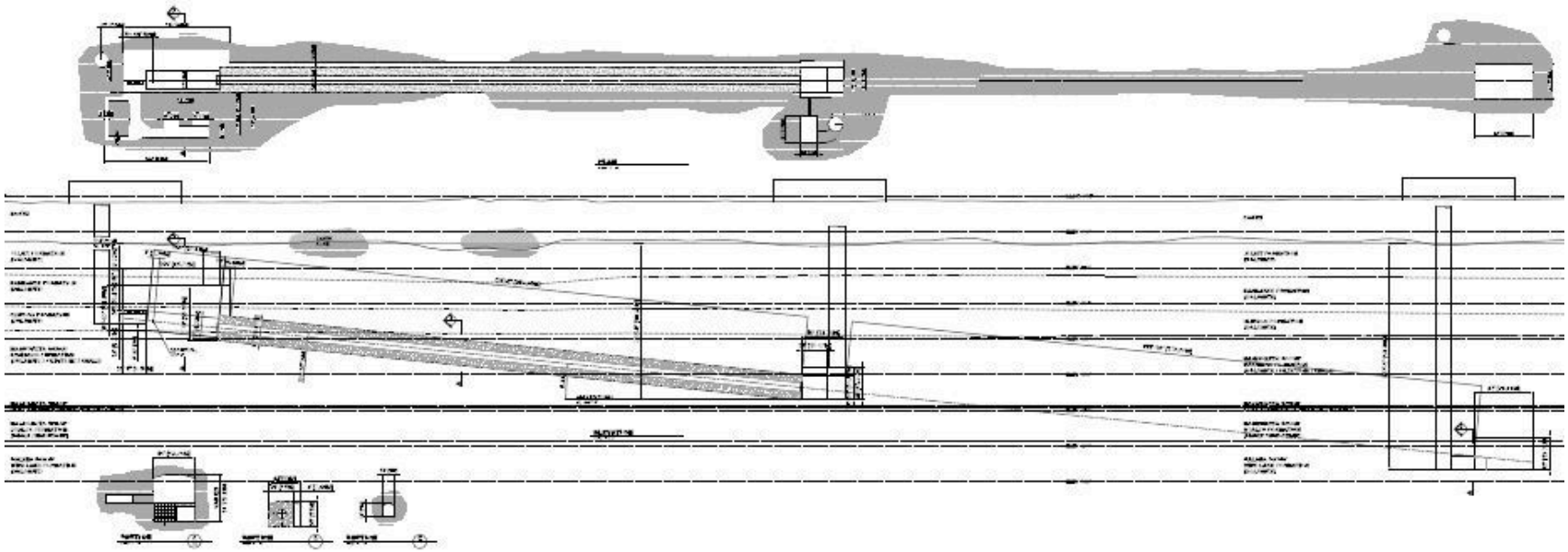
- **4) A weaknesses of the NuMI target hall** is that **during repairs**, a radioactive component is carried from the crane unshielded by a coffin; **a crane failure during one of these operations would cause considerable headaches**. The weight of a coffin able to shield a horn is in fact higher than the crane capacity. **This leads one to the concept of a side-loaded target pile, where a target or horn is rolled out of the target pile on rails.** The rail could lead through an area for diagnosing and possibly repairing components, then directly to a tunnel for long-term storage of broken horns and target. The side-loaded target scheme leads naturally to a wider target hall being required.

Target Hall & Decay Concept
(At this stage defining volume needs)



Elevation View with Rock Strata



Facility Depth & Length Effects

- With the target depth and hall length as defined, along with a 250 meter decay region, the beam facility (Pre-target primary, target hall, decay tunnel and absorber hall) is in good rock strata for mined rock construction. Good experience from NuMI construction in this same region.
- The near detector hall has significant added constraints:
  - At depth of Galena-Platteville strata; good for construction, but rock fissures reaching depths of community wells. Look to keep ground water from beam system tunnels away from this area.
  - Proximity to near-by residences. May have to drill only to construct shaft(s) [instead of drill and blast]. This adds constraint on shaft size to ~16 ft. finished diameter. Also hall mining only during reduced hours.
- **We need better definition for near detector hall space needs and access shaft requirements.**

Planning the Construction Process

- We look toward being able to do the underground facility construction in parallel with NOvA beam operation. As for most of NuMI construction, we should be able to operate the accelerator complex during this process.
- A tie-in period when the accelerator complex is off will be needed to build the close-in "conventional construction" facilities. This includes the separation of DUSEL primary beam tunnel from existing NuMI/NOvA line, the shallow horizontal bend DUSEL primary tunnel, and the tie-in tunnel for Project X beam injection to Main Injector.